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LOUIS LAFORCE McQUITTY

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IN THE SENATE CHAMBER

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THESIS

An Approach to the Measurement of Individual Differences in Personality

(Summary)

The thesis outlines an approach to the measurement of individual differences in personality. The approach was suggested by a gross comparison of mental hospital patients and college students. The comparison was refined by means of an original method of scaling and scoring the answers given to psychological inventories.

The investigation began with the assumption that there are marked individual differences in the inter-relationships among statements that are affirmed or denied, particularly when these statements involve relationships between the person and objects. Individual differences of this kind are especially obvious when the statements of mental hospital patients are compared with those of normal people.

Accordingly, the Strong Vocational Interest Blank was used as a means of obtaining a sample of the expressed likes and dislikes of 262 college students. A method was devised for determining the degree of inter-relationship reflected in the answers given by the students to the questions on the Blank. The relationship investigated between pairs of answers was called *Concomitance*. This would have a maximum value if each individual who gave one answer of a given pair also gave the other answer. Concomitance would be less to the extent that some individuals gave one answer of a pair and not the other. Scale values for pairs of answers were obtained, and hence a Concomitance score was determined for each individual on the basis of his own answers.

A criterion for the selection of pairs of answers was developed and tested. Pairs of answers selected by means of it were found to be better measures of Concomitance than other pairs of answers.

The data obtained with college students served to demonstrate Concomitance as a measurable factor. Some indication of the breadth of the factor was obtained by applying the same scaling and scoring technique to the Bernreuter Personality Inventory, which proved, when treated by the method of the thesis, to be a measure of the same factor as in the case of the Strong Vocational Interest Blank. A value of the scale of Concomitance demonstrated in the thesis is that it *measures* a difference between mental hospital patients and normal adults.

As a tentative psychological interpretation of the factor of Concomitance the suggestion was offered that, while a Scale of Intelligence has to do with relationships of thought objects, a Concomitance Scale is concerned with the relationship between the Self and such objects.

GRADUATE STUDIES

Major Subject:

Individual Differences—Professor W. Line.

Minor Subjects:

Experimental Psychology—Professor E. A. Bott.
Anthropology—Professor T. F. McIlwraith.

AN APPROACH TO THE MEASUREMENT OF INDIVIDUAL DIFFERENCES IN PERSONALITY

Louis L. McQuitty

A Thesis submitted in conformity
with the requirements for
the degree of
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Table of Contents

I. Introduction ----------1

II. Historical Review----------1

A. The Investigation of Individual Differences----------1

B. The Methods of Dealing with Inventory Answers----------4

III. A Factor, Significant in Personality Differences----------9

A. The Logic of the Search----------9

B. The Logic Involved in the Selection of Pairs of Questions----13

C. Demonstration of the Factor----------14

D. Breadth and Practical Significance of the Factor----------19

IV. Reliability of Questions - A Possible Further Investigation---------22

V. Interpretation of the Factor----------23

VI. Summary----------24

Appendix - A Method of Scaling and Scoring Inventory Answers.

AN APPROACH TO THE MEASUREMENT OF INDIVIDUAL DIFFERENCES IN PERSONALITY

I Introduction

This study outlines an approach to the measurement of individual differences in personality. The approach was suggested by a gross observational comparison of mental hospital patients and college students. The observational comparison was refined by means of an original method of scaling and scoring the answers given to psychological inventories.

II Historical Review

Individual differences have been discovered in various aspects of behaviour, such as intelligence, perseveration, attitudes, vocational interests, neurotic tendencies, etc.; and personality differences have been investigated by the use of "personality inventories". A brief survey of the plan usually adopted in the investigation of individual differences, may serve to indicate the principles to be followed in a further investigation, such as the one herein reported; and a review of the methods of dealing with inventory answers may indicate a fruitful combination of the characteristics of several methods.

A. The Investigation of Individual Differences.

Individual differences in various aspects of behaviour have been

first noted by gross observational comparisons of groups of individuals. These observational comparisons have then been refined by means of measurement techniques. For example, gross observational comparisons indicated intellectual differences between idiots and geniuses at least as far back as Plato and Aristotle. Some 2000 years later, the gross observational comparisons were refined by means of the measurement technique of Binet.

The measurement techniques have involved the following assumptions:-

(a) a linear continuum;

(b) that tests or test-items can be allocated on the continuum, in a graduated order, according to a defined principle;

(c) that the test or test-items can be used to allocate individuals along the continuum.

For example, Thurstone (1) has assumed an "Attitude toward the Church" continuum; and has allocated test-items on the continuum in a graduated order, according as the items indicate degrees of favourability, indifference, or antagonism toward the church. These test-items may then be used to allocate individuals on the same continuum. Similarly, Binet has assumed the temporal continuum, and has allocated tests on it in accordance with the percentages of children in various age groups who pass the tests. The tests may then be used to allocate individuals on the same continuum.

The assumption of a continuum, and the allocating of test-items and individuals on it, are said to be justified, and the results obtained with the continuum are said to be psychologically significant, if:-

(a) the results differentiate between individuals in a

manner similar to that of another criterion (e.g. the observational comparison);

(b) two or more continua with different tests or test-items give similar results;

(c) the tests or test-items show internal consistency;

and if (d) the attribute or factor measured can be given psychological meaning.

The present study (a) began with an observational comparison of groups of individuals - mental hospital patients, and college students; and (b) refined the observational comparison by means of a measurement technique. It assumed:-

(a) a linear continuum;

(b) that test-items can be allocated on the continuum;

(c) that these items can be used to allocate individuals on the continuum.

It maintains that the assumptions are justified and that the results obtained are psychologically significant, because:-

(a) the results differentiate between individuals in a manner similar to that of the observational criterion;

(b) two continua with different test-items give similar results;

(c) the test-items show internal consistency;

and (d) the factor measured can be given psychological meaning.

B. The Methods of Dealing with Inventory Answers

Three methods have been widely used in dealing with inventory answers. One method is illustrated in G. Stanley Hall's (2) work with questionnaires. This method is merely to enumerate the number of times each answer is given by various groups of subjects. No provision is made for assigning a composite score for several answers.

A second method is illustrated by Strong's (3) work with The Vocational Interest Blank. This method provides for the assigning of composite scores. Each possible answer is assigned a numerical value. When the blank is administered, each individual gives certain answers. The composite score for an individual is the sum of the numerical values of the answers which he gave.

In using this method, some such plan as the following is usually adopted in order to determine the numerical value of each answer. Two groups of individuals are selected. One group might be the patients in a mental hospital; the other might be persons living in the community. The inventory is administered to each group. Any answer given by a large percentage of patients and a small percentage of community persons is assigned a large positive numerical value. Any answer given by a small percentage of patients and a large percentage of community persons is assigned a large negative numerical value. Thus each answer is assigned a numerical value in accordance with the percentage of persons in each group which give it.

This method puts no restriction on the questions which may be included in the inventory. It makes possible a wide range of questions.

But it makes no provision for assuring that the composite scores are measures of a single, defined variable.

A third method is illustrated by Thurstone's (1) work with attitude scales. This method makes provision for assuring that the composite scores are measures of a "single, defined variable" (4). The definition of the variable exercises a selective influence on the questions (1, pp.11-14) and is supported in this respect by an objective criterion for the selection (ibid., pp.44-56). For example, the "Attitude toward the Church" variable excludes all questions which do not portray an attitude of favourability, indifference, or antagonism toward the church.

The method described in this paper:-

(a) makes provision for composite scores;

(b) makes possible the use of a wide range of questions;

and (c) makes provision for assuring that the composite scores are measures of a single, defined variable.

Thus far we have indicated some of the general principles involved in the measurement of individual differences, and in the use of personality inventories. In so doing, some of the principles followed in the present investigation have been clarified.

Before describing in detail the procedure adopted in our study, a further historical note should be considered. The reason for this is that the present investigation may be said to illustrate a transition in personality

studies similar to that which was made in the studies of mental abilities. This will become clear as we proceed.

Earlier studies of mental abilities concerned themselves with such categories as sensory discrimination, reaction time, accuracy of movement, time perception, imagination, etc., - as illustrated by the investigations of Cattell and Wissler (5). It would seem that the investigators were attempting a detailed analysis of mental abilities. Binet appears to have started in much the same manner. But his analysis became less and less detailed as his investigations proceeded; and his final contention was that he had measured general intelligence. This transition away from detailed analysis was accompanied by:-

(a) provisions for composite scores;

(b) provisions for a wide range of tests;

(c) a method of scaling the tests;

and (d) an exceptional increase in the practical significance of the tests.

A further point is involved in this transition from specific to more general abilities. Spearman (6) in his studies of the abilities of man and Binet in his later, more significant studies, used an analytic approach. But their use of analysis appears to have been different from that illustrated by the work of Cattell and Wissler. In the latter approach the investigators may be said to have analyzed behaviour on the basis of some objective criterion. For example, the criterion may be the geography of the body, as illustrated in the distinction between visual and tactual discrimination. It may be concerned with the configuration of observed objects, as illustrated in the

distinction between visual discrimination of lengths of lines and visual discrimination of sizes of cubes. After the analysis, an attempt may be made to investigate the "psychological" relationships between the elements, by means of the correlation technique. For example, the "psychological" relationship between tactual discrimination and visual discrimination may be investigated by a computation of the correlation coefficient between scores obtained for these tests. In this approach, the experimental evidence appears to precede the discovery of psychological relationships.

In the approach of Spearman, and of Binet in his later work, it appears that psychological relationships are usually apprehended on the basis of gross observations before experimental evidence is accumulated. Critical experiments are then performed. These experiments serve to deny the validity of the assumed relationship, or to illustrate, substantiate, and perhaps clarify it. It appears that, in the search for an important, practical psychological relationship, both Binet and Spearman had in mind a cognitive function which expresses itself in a wide range of behaviour. They appeared to assume that if such a function could be found, (a) it could be investigated by means of testing techniques and (b) the test scores would be interrelated. The interrelationships are then illustrations of functional unity.

Spearman (ibid-appendix) having postulated functional unity, proved that the interrelationships would follow a statistically defined pattern; he showed how the pattern could be used in investigating functional unities; and he called the functional unities 'factors'. He (7) also illustrated how a psychological interpretation of a factor could be derived from a study of the tests used in the measurements of that factor.

The above discussion is pertinent to the present investigation, in that:-

(a) The investigator here searched for a cognitive function which, from gross observation, he thought would express itself in a wide range of behaviour, the behaviour being that commonly said to be indicative of individual differences in personality.

(b) A testing technique was developed in order to investigate the function.

(c) The Spearman pattern or factor technique as elaborated by Thurstone (8) was applied in investigating the function.

(d) An indication of the usefulness of the function was obtained from experimental evidence.

(e) A tentative psychological interpretation of the function was derived from a study of the tests used in its measurement.

III A Factor, Significant in Personality Differences.

A. The Logic of the Search.

In seeking a factor of significance in the field of Personality-measurement, the following preliminary assumptions were made:

(a) That individuals think, i.e. they see relationships between concepts.

(b) That each individual at a given time may be said to accept certain relationships as principles or postulates.

(c) That there are individual differences in the inter-relationships among the accepted postulates. This is especially obvious when the statements of mental hospital patients are compared with those of normal people.

The investigation therefore concerned itself with the following problems:

(1) To obtain a sample of the accepted postulates of a number of individuals.

(2) To measure the degree of inter-relationship reflected in each individual's sample.

Problem I may be approached by asking individuals such questions as the following:

(a) Do you like, dislike, or are you indifferent to Golf?

(b) Do you like, dislike, or are you indifferent to Arguments?

(c) Do you like, dislike, or are you indifferent to Foreigners?

An individual's answer to question a will usually be the equivalent of

I like Golf,

I dislike Golf,

or I am indifferent to Golf.

Each of these possibilities involves the concepts 'I' and 'Golf'; and a relationship - 'like', 'dislike' or 'am indifferent to' - is affirmed. The particular answer given to question a may therefore be regarded as an accepted postulate. Similarly with answers to questions b and c.

In order to obtain a more comprehensive sample of an individual's answers, or accepted postulates, an inventory of many questions may be administered. Such an inventory would be The Strong Vocational Interest Blank, for example.

Problem 2. Having obtained a sample of answers given by a group of individuals, the next step is to measure the inter-relationships among the answers in a manner that will give comparable scores for the individuals of the group. This may be accomplished as follows:-

Let us consider the answers, or accepted postulates, to any two questions. The possible pairs of answers to questions a and b (above) are:

i. I like Golf, and I like Arguments.

ii. I like Golf, and I dislike Arguments.

iii. I like Golf, and I am indifferent to Arguments.

iv. I dislike Golf, and I like Arguments.

v. I dislike Golf, and I dislike Arguments.

vi. I dislike Golf, and I am indifferent to Arguments.

vii. I am indifferent to Golf, and I like Arguments.

viii. I am indifferent to Golf, and I dislike Arguments.

ix. I am indifferent to Golf, and I am indifferent to Arguments.

Suppose now that these pairs of answers have been obtained by administering questions a and b to a group of individuals. The relationship between answers of a pair may be regarded as Concomitance, in the sense that Concomitance will be maximal if each individual who gave one answer of the pair gave also the other answer; Concomitance will be less to the extent that some individuals gave one answer of the pair and not the other.*

On this basis, a coefficient of the degree of relationshio here called Concomitance may be computed thus:-

Let nx = the number of individuals who gave one answer (x) of a pair of answers x and y.

ny = the number of individuals who gave the other answer (y) of the pair.

nxy = the number of individuals who gave both answers (x and y).

Let Cxy be the Concomitance between answers x and y.

It will be seen that Cxy is related to $\frac{nxy}{nx}$ and to $\frac{nxy}{ny}$. For reasons that are set forth in the Appendix (pp.3-4), Cxy is taken as being a function of the geometric mean between $\frac{nxy}{nx}$ and $\frac{nxy}{ny}$. We may accordingly state that

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* The statistical meaning of Concomitance is elaborated in the Appendix, p.1.

$$Cxy = f\sqrt{\frac{nxy}{nx \cdot ny}} \qquad \text{----------(1)}$$

The functional relation involved in this equation is assumed to be that of the normal probability curve. (See Appendix, p. 5). The equation then makes possible the scaling of each pair of answers according to the degree of concomitance; for nx, ny, and nxy are empirically determinable values. The steps involved here are:-

(a) Determine nx, ny, nxy empirically for a given pair of answers.

(b) Compute the value $\sqrt{\frac{nxy}{nx \cdot ny.}}$

(c) With this value as the ordinate of a normal probability curve, look up the corresponding standard deviation in a Table.*

The standard deviation is the required value, Cxy, - namely, the scale value of concomitance for the pair.

In this manner the scale values of all possible pairs of answers, obtained by administering a long list of questions to a group of individuals, may be calculated.

When this has been done, the scale values may be employed in determining the degree of concomitance reflected in the answers (the accepted postulates) of any given individual. In order to do this:

(a) Consider the answers given by an individual to the questions of the inventory.

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* Use a Table in which the maximal ordinate is unity.

(b) Consider every possible pair of these answers. Each pair of answers has a scale value.

(c) Compute an average of the scale values. This average is here accepted as the individual's measure of Concomitance. It is regarded as a measure of the inter-relationships among his accepted postulates.

B. The Logic Involved in the Selection of Pairs of Questions.

If pairs of questions are to be used in determining individual differences of the type outlined above, some pairs may be more suitable than others. The following considerations will illustrate this:-

(a) Do you like (dislike etc.) driving a motor-car?

(b) Do you like (dislike etc.) driving an automobile?

These questions, involving the synonyms 'motor-car' and 'automobile', are so similar that most, if not all, individuals would interpret them alike. Question b would accordingly involve the same 'accepted postulate' as Question a. The same could be said of a pair of questions involving antonyms.

This means that, in the case of Questions a and b, only the following pairs of answers would be likely to occur:-

like (a) and like (b); dislike (a) and dislike (b);

indifferent to (a) and indifferent to (b).

These pairs of answers would have maximal concomitance; for each individual who gave one answer of any pair would be likely also to give the other. The "not given" pairs of answers [e.g. like (a) and dislike (b)] would have a minimal concomitance, for no individual who gave one answer of such a pair

would be likely to give the other.

A mathematical formula was accordingly developed for measuring the extent to which pairs of questions approach the conditions indicated above. It is called "A Criterion for the Selection of Pairs; and its statistical derivation is outlined in the Appendix (p. 11).

Having outlined the logic of the search, and a method of procedure, we now pass to the demonstration of the factor.

C. Demonstration of the Factor.

In order to demonstrate the factor, an experimental study was made. In this study, the Strong Vocational Interest Blank was used. This inventory contains eight groups of questions. Five of these groups are designed to indicate interests in the following fields: Occupations, Amusements, School Subjects, Activities, and Peculiarities of People; and these groups were employed in the present investigation.

The directions for the several groups are similar or identical. The directions for the first group, Occupations, are as follows:

> "Indicate after each occupation listed below whether you would like that kind of work or not. Disregard considerations of salary, social standing, future advancement, etc. Consider only whether you would like to do what is involved in the occupation.
>
> Draw a circle around L if you would like that kind of work.
> Draw a circle around I if you are indifferent to that kind of work.
> Draw a circle around D if you dislike that kind of work.
>
> Work rapidly. Your first impressions are desired here. Answer all the items. Many of the seemingly trivial and irrelevant items are very useful in diagnosing your real attitude."

The first few items are:

1. "Actor (not movie)----L I D		Lawyer, Criminal----------L I D	
2. Advertiser----------L I D		Lawyer, Corporation--------L I D	
3. Architect----------L I D		Librarian----------L I D	
4. Army Officer---------L I D		Life Insurance Salesman----------L I D	
5. Artist----------L I D		Locomotive Engineer--------L I D	

262 blanks were taken at random from the files in the Department of Psychology at the University of Florida. The files contained all the blanks which had been administered to second year, University of Florida, male students during the period September, 1929 to January, 1936.

The method of scaling was applied to these results. All possible pairs of answers were not scaled. The work necessary to scale all possible pairs of answers for even a small number of questions is quite laborious. An alternative plan is (a) to use many questions, and (b) to scale a selected number of pairs of answers to these questions. This plan was adopted because, by taking many questions, the range of interests sampled was greater than if only a few questions had been used. The pairs of answers selected for scaling were those which pertained to questions (1,2), (3,4) etc. etc. It will be remembered that for each pair of questions, nine possible pairs of answers are involved, since each question requests one of the three answers L, I, D.

The resultant scale values are shown in the Appendix pp. 18 - 24.

The factor was then investigated as follows:

(1) Strong Vocational Interest Blanks were administered to an introductory psychology class of forty-seven male students at the University of Florida. These blanks were not used in the determination of scale values.

(2) The numerical value of the Criterion for the Selection of Pairs was computed for each pair of questions. These

values were determined from the scale values and are shown in the Appendix, pp. 18 - 24.

(3) On the basis of these values, the pairs of items were divided into five tests. Test One contains the eighteen pairs having the smallest values. Test Two contains the thirty-six pairs having the next smallest values. Test Three contains the fifty-four pairs having the next smallest values. Test Four contains the seventy-two pairs having the next smallest values. Test Five contains the remaining pairs.

(4) Each of the forty-seven blanks was scored four times, once for each of the first four tests. Each test was scored as outlined on pages 12 and 13, save that only the pairs of answers which had been scaled were considered in the scoring.*

(5) Each test was correlated with each of the other tests, and the factor loading for each test was calculated by the Thurstone (8) technique. The coefficients of correlation and the factor loadings are shown in Table I.

Table I

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(6) The Spearman-Brown prophecy formula (10) was applied to predict what the factor loadings of Tests Two, Three,

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* It will be recalled that all possible pairs were not scaled.

Table I - Correlation Coefficients and Factor Loadings

	Test One	Test Two	Test Three	Test Four
Test One		0.46	0.24	0.24
Test Two	0.46		0.43	0.25
Test Three	0.24	0.43		0.36
Test Four	0.24	0.23	0.36	
Factor Loadings	0.59	0.67	0.69	0.50
Predicted Factor Loadings	0.59	0.74	0.81	.85
Discrepancy Values	0.00	0.07	0.19	.35
Average Values of the Criterion for the Selection of Pairs	0.08	0.23	0.68	1.18

and Four would have been if the pairs of answers in them were equal in factor loadings to the pairs in Test One. These predicted loadings are also shown in the Table.

(7) For each test, the factor loading was substracted from the predicted factor loading to give the discrepancy value, also shown in the Table.

It will be observed that the factor loading of each test exceeds any coefficient of correlation in the Table. Hence we may conclude that the correlations are completely accounted for on the assumption of but one common factor - here called Concomitance, and interpreted as referring to the interrelationships among an individuals accepted postulates.

The bottom row of the table shows for each test the average value of the Criterion for the Selection of Pairs. The Criterion, as shown in the Appendix, page 14, is completely satisfied only if it equals zero, and it is less satisfied as it is larger. The values of the criterion for the successive tests are 0.08, 0.29, 0.68 and 1.42. The corresponding discrepancy values are 0.00, 0.07, 0.19, and 0.35. These latter values are measures of the extent to which the pairs of questions of the successive tests are poorer measures of the factor than are pairs of Test One. They increase as the pairs are poorer measures. They increase as the Criterion increases. This demonstrates that the Criterion has possibilities in improving the efficiency of a test as a measure of Concomitance.

At this point, it is interesting to note that not only does the Criterion select pairs of questions in such a way as to increase the efficiency

of the test, but also that it does this in accordance with the purpose for which it was created.

Below are listed from each group of interests (a) the two pairs of questions with the highest values for the Criterion (b) the two pairs of questions with the lowest values for the Criterion, and (c) the Value of the Criterion for each pair. The question in each case is: "Do you like, dislike, or are you indifferent to ----------"

Value of Criterion	Good Pairs	Value of Criterion	Poor Pairs
0.02	Editor Electrical Engineer	3.25	Locomotive Engineer Machinist
0.02	Life Insurance Salesman Locomotive Engineer	3.17	Marine Engineer Mechanical Engineer
0.10	Billiards Observing birds (nature study)	3.50	Picnics Excursions
0.06	Musical comedy Symphony concert	3.45	Art Galleries Museums
0.04	Literature Mathematics	2.46	Geography Geology
0.01	Public Speaking Shop work	2.58	Manual Training Mechanical Drawing
0.10	Pursuing bandits in a sheriff's posse Doing research work	2.88	Adjusting a carburetor Repairing electrical wiring.
0.06	Doing research work Acting as a yell-leader	2.88	Raising flowers and vegetables. Decorating a room with flowers.
0.07	Quick-tempered people Optimists	2.74	Very old people Cripples
0.07	Side-show freaks People with good teeth	3.13	Blind people Deaf mutes

It will be noted that in each poor pair, the two members of that pair are very similar. Hence these pairs resemble the automobile-motor car illustration discussed when the logic of the Criterion was given.

D. The Breadth and Practical Significance of the Factor.

Having demonstrated the factor throughout a wide range of interest-questions, we now proceed to test its breadth of application further. This phase of the investigation was carried on in conjunction with another demonstration, namely that the factor may be significant in differentiating between college students and mental hospital patients. It will be recalled that the factor was first suspected from a gross observational comparison of college students and mental hospital patients.

The Bernreuter Personality Inventory was used. The directions and first few questions are as follows:

> "The questions on this blank are intended to indicate your interests and attitudes. It is not an intelligence test, nor are there any right or wrong answers.
>
> "In front of each question you will find: 'Yes No ?'.
>
> "If your answer is 'Yes', draw a circle around the 'Yes'. If your answer is 'No', draw a circle around the 'No'. If you are entirely unable to answer either 'Yes' or 'No' to the question, then draw a circle around the question mark.
>
> 1. Yes No ? Does it make you uncomfortable to be "different" or unconventional?
> 2. Yes No ? Do you day-dream frequently?
> 3. Yes No ? Do you usually work things out for yourself rather than get someone to show you?
> 4. Yes No ? Have you ever crossed the street to avoid meeting some person?
> 5. Yes No ? Can you stand criticism without feeling hurt?"

262 Bernreuter Inventories were taken from the same source as the

Strong Blanks,(p.15). The method of scaling was applied to these results. In order to lessen the volume of work, (a) answers to only the first 73 questions on the Bernreuter Inventory were used, and (b) as in the case of the Strong Blank (p.15), the possible answers to any one question were paired only with the possible answers to its preceding question and its succeeding question. These pairs were scaled.

The criterion for the selection of pairs of questions was applied. The average value of the criterion for all pairs was found to be 0.26. Since this value is less than the corresponding value of Test Two of the Strong Blank (Table I), all pairs of questions were retained. The values of the criterion and the scale values are shown in the Appendix, p.25 .

Bernreuter Inventories were administered to the same forty-seven students as were the Strong Blanks (p.15). In addition, Inventories and Blanks were administered to thirty-six male, mental hospital patients. The patients included 13 paretics and 14 schizophrenics in the Ontario Hospital, Toronto, and 5 schizophrenics and 4 manic-depressive psychotics in the Toronto Psychiatric Hospital. With students and patients, one week elapsed between administration of the blanks and the inventories.

The inclusion of mental hospital patients suggested a further refinement of the method of obtaining an individual's average score of Concomitance. This method was developed and adopted. It was designed to take care of the possibility that there may be individual differences in how much a person "likes" before he will say: "I like --". Similarily for "dislike", etc. The method and its statistical development are outlined in the Appendix, p.14.

Tests One, Two and Three were combined in scoring the Strong Blanks.

Test Four was omitted because its factor loading, as shown in Table I, is much lower than the factor loadings of the other tests, and is lower in spite of the fact that Test Four contains four times as many questi ns as Test One.

The scores for college students and mental hospital patients are shown in Table II. It will be noted that the college students' scores are

Table II

comparatively low - indicating high Concomitance - and that the mental hospital patients' scores are comparatively high - indicating low Concomitance - on both the Strong Blank and the Bernreuter Inventory.

This degree of differentiation was obtained with tests of Concomitance which admit of much improvement. A criterion for obtaining this improvement has already been developed and tested (p.17). That an improved test of Concomitance would give greater differentiation between the two groups is demonstrated because of the following facts:

(a) Fewer Inventory questions were used than Blank questions, namely 73 and 108.

(b) The criterion for pairs of questions is better satisfied with the Inventory than with the Blank, its average value being 0.26 on the Inventory and 0.45 on the Blank.

(c) The Inventory Concomitance scores of college students and mental patients show less overlap than do the Blank Concomitance scores.

The above facts suggest, therefore, that the factor Concomitance has practical significance because it may be used to differentiate between groups of individuals.

Table II- Scores of Concomitance for Mental Patients and College Students

The Bernreuter Personality Inventory			The Strong Vocational Interest Blanks		
Scores of Concomitance	Frequency of Mental Patients	College Students	Scores of Concomitance	Frequency of Mental Patients	College Students
4.15-4.54	1		2.30-2.49	1	
3.75-4.14	2		2.10-2.29	2	
3.35-3.74	3		1.90-2.09	1	
2.95-3.34	0		1.70-1.89	5	
2.55-2.94	1		1.50-1.69	0	
2.15-2.54	4		1.30-1.49	5	
1.75-2.14	9	1	1.10-1.29	3	1
1.35-1.74	6	1	0.90-1.09	3	0
0.95-1.34	4	1	0.70-0.89	2	2
0.55-0.94	4	5	0.50-0.69	5	1
0.15-0.54	2	10	0.30-0.49	1	7
-0.25-0.14		7	0.10-0.29	2	6
-0.65--0.26		11	-0.10-0.09	4	13
-1.05--0.66		8	-0.30--0.11	2	9
-1.45--1.06		3	-0.50--0.31		4
			-0.70--0.51		1
			-0.90--0.71		2
			-1.10--0.91		0
			-1.30--1.11		1
Totals	36	47	Totals	36	47

The correlation between the Inventory Concomitance scores and the Blank Concomitance scores was found to be 0.63 ± 0.04. This demonstrates that the factor is common to the two inventories. It may be common to a wide variety of inventories and may possibly be expressed in a very broad range of behaviour.

IV Reliability of Questions - A Possible Further Investigation

An important further investigation would appear to be the following: All questions could be repeated, and measures of reliability computed by means of the methods outlined in this paper. The questions could be repeated for purposes other than the determination of statistical reliability. Assuming, as was done in this investigation, that these questions investigate an individual's accepted postulates; by repeating them it should be possible to investigate the constancy of those postulates. It is not necessary to assume, as is so commonly done, that the answer to a question is unlawful and meaningless just because the same answer does not again occur when the question is repeated to the same individual. The question can not be repeated under "identical" conditions, not perhaps to the "same" person, for time has changed, and perhaps also the person.

The repetition of questions to investigate the constancy of accepted postulates would be an interesting elaboration of this investigation. From a gross observational comparison of paranoids, manic-depressive (manic-phase) psychotics, and college students, it would appear that the first two not only differ from the latter in the degree of inter-relationship among their accepted

postulates, but that also the first two differ from each other in degree of constancy of their accepted postulates. It is also true that college students might differ from each other in the same manner. It is supposedly possible for an individual to have (1) highly interrelated and rapidly changing postulates; (2) highly interrelated and slowly changing postulates; (3) relatively uninterrelated and rapidly changing postulates; or (4) relatively uninterrelated and slowly changing postulates. These possibilities could readily be investigated on the basis of the techniques herein discussed.

V Interpretation of the Factor

The following is suggested as a tentative interpretation of the factor under consideration:

Intelligence may be interpreted in terms of seeing relationships between thought objects. In tests of intelligence, relationships between concepts are usually involved. But in these tests, the "concepts" between which the relationships mediate are usually, if not invariably, different from those involved in the inventories used in this study. The inventory questions and answers invariably involved the personal concept "I". In accord with this, the factor here demonstrated is said to be a factor of individual differences in Personality.

Intelligence tests may be thought of as tests of the manner in which individuals interrelate "objective" concepts. Tests of Concomitance may be thought of as in some way referring to the manner in which the individual's "Personal" or "self" concept is related within his scheme of "objective" concepts.

Thus relating A to B would come under the function of "intelligence". The facts that an individual *likes* A, *dislikes* B etc. would, in their relationship, involve the personality characteristic here called 'Concomitance'. If this or any analogous interpretation of the facts is proceeding in a legitimate direction, tests of *Concomitance*, when refined, might prove to be very worthwhile instruments of research. It is possible that questions for the measurement of *Concomitance* could be standardized on children. Genetic studies of childrens' adjustment to their environment, - studies in which Concomitance measures were included, - would then give a much richer basis for exploring and interpreting this factor further.

VI Summary

This investigation began with the following assumptions:

(a) That individuals think, i.e. that they see relationships between concepts.

(b) That each individual at a given time may be said to accept certain relationships as principles or postulates.

(c) That there are individual differences in the interrelationships among the accepted postulates. This is especially obvious when the statements of mental hospital patients are compared with those of normal people.

(d) That a sample of an individual's postulates could be obtained by asking him questions.

(e) That the degree of interrelationship of an individual's accepted postulates would be reflected in the degree of *Concomitance* of his answers.

Individual differences were demonstrated in the Concomitance of of answers to questions. An individual's Concomitance of answers on one inventory was demonstrated to be similar to his Concomitance of answers on another quite different inventory. A criterion for the construction of an efficient test of Concomitance was developed, and demonstrated to be useful for that purpose. Concomitance was shown to be a significant factor in that (a) inefficient tests of it were demonstrated to differentiate between college students and mental hospital patients and (b) a more efficient test gave greater differentiation between the groups.

A tentative psychological interpretation of the Concomitance factor was offered, and a few of the possible further lines of investigation were suggested.

A METHOD OF SCALING AND SCORING INVENTORY ANSWERS
(A P P E N D I X)

Table of Contents

I. The Concomitance of Inventory Answers----------1

A. The Degree of Concomitance----------1

B. The Development of an Equation for Determining the degree of Concomitance----------3

II. A Criterion for the Selection of Pairs----------11

III. A Refined Method of Scoring----------14

Scale Values for Pairs of Answers on the Strong Vocational Interest Blank----------18

Scale Values for Pairs of Answers on the Bernreuter Personality Inventory----------25

Correlations and Standard Deviations

I The Concomitance of Inventory Answers

The variable here considered is concomitance of inventory answers. When an individual fills out an inventory, he gives various answers. These may be paired to give various pairs of answers. An individual's answers are just as concomitant as are the pairs derived from them. A pair of answers is completely concomitant if the answers of the pair always occur together, i.e. if every individual who gives one answer gives also the other answer. A pair of answers is less concomitant to the extent that some individuals give one answer and not the other answer. A method was developed (1) for assigning a numerical value for each pair of answers and (2) for assigning each individual's answers a composite score of concomitance. This method is outlined in the following discussion:

A. The Degree of Concomitance

Two answers represent maximum concomitance if every subject who gives one answer gives also the other answer. Consider the following questions:

Example I:

1. Yes No ? Do you dream frequently?

2. Yes No ? Is your sleep restless?

Suppose that these questions have been presented to 100 subjects and that:

(a) 50 subjects answered Yes for question 1.

(b) 50 subjects answered Yes for question 2.

(c) The 50 subjects who answered Yes for question 1 are the 50 subjects who answered yes for question 2.

In such a case, the answers Yes 1 and Yes 2 represent maximum concomitance. Every subject that gave either answer also gave the other answer.

The concomitance becomes less to the extent that some subjects give the one answer and not the other. Consider the following questions:

Example 2:

3. Yes No ? Do you like to be alone?

4. Yes No ? Do you make friends easily?

Suppose that these questions have been presented to 100 subjects and that:

(a) 50 subjects answered Yes for question 3.

(b) 30 subjects answered Yes for question 4.

(c) The 30 subjects who answered Yes for question 4 are included in the 50 subjects who answered Yes for question 3.

The Concomitance between Yes 3 and Yes 4 is less than the concomitance between Yes 1 and Yes 2.

The concomitance becomes still less when not only do some subjects give the first answer and not the second, but in addition, other subjects give the second answer and not the first. Consider the following questions:

Example 3:

5. Yes No ? Are your feelings easily hurt?

6. Yes No ? Are you submissive in a crowd?

Suppose that these questions have been presented to 100 subjects and that:

(a) 50 subjects answered Yes for question 5.

(b) 30 subjects answered Yes for question 6.

(c) 20 of the 30 subjects who answered Yes for question 6 are included in the 50 subjects who answered Yes for question 5.

The concomitance between Yes 5 and Yes 6 is not only less than the concomitance between Yes 1 and Yes 2; it is also less than the concomitance between Yes 3 and Yes 4.

The concomitance between any two answers, x and y, is thus related to the following empirically obtainable variables:

nx = the number of subjects giving answer x.

ny = the number of subjects giving answer y.

nxy = the number of subjects giving both answer x and answer y.

We can determine empirically the concomitance between any two answers if we can devise an equation which expresses the relationship between their concomitance and nx, ny, and nxy. We proceed with this task.

B. The Development of an Equation for Determining the Degree of Concomitance

Let:

Cxy = the concomitance between any two answers x and y.

From example 1, page 3:
Cxy is a maximum when nx = ny = nxy.

From example 2, page 4:
Cxy is less when ny = nxy < nx.
Or analogously:
Cxy is less when nx = nxy < ny.

From example 3, page 4:
Cxy is still less when nxy < nx and < ny.

We want, therefore, a combination of nx, ny, and nxy which will give for Cxy:

(1) a maximum value when nx = ny = nxy.
(2) a smaller value when ny = nxy < nx
or when nx = nxy < ny
(3) a still smaller value when nxy < nx and < ny.

Any measure of the mean between the two ratios $\frac{nxy}{nx}$ and $\frac{nxy}{ny}$ will give such a combination. The geometric mean is the mean selected because the two ratios do not have the same base, and the geometric mean is the only mean of such ratios (9). In $\frac{nxy}{nx}$, the base is nx, and given the value of ratio and base, one may multiply to determine nxy. In $\frac{nxy}{ny}$, the base is ny, and similarly, one may multiply to determine nxy. The geometric mean is $\frac{nxy}{\sqrt{nx \cdot ny}}$.

It will be noticed that $\frac{nxy}{\sqrt{nx \cdot ny}}$ is:

(1) a maximum value (namely 1) when nx = ny = nxy.
For example, let:
nx = ny = nxy = 50
Then:
$$\frac{nxy}{\sqrt{nx \cdot ny}} = \frac{50}{\sqrt{50 \times 50}} = 1.00$$

(2) a smaller value when ny = nxy < nx
or when nx = nxy < ny
For example, let;
nx = 50
ny = nxy = 30
Then:

$$\frac{nxy}{\sqrt{nx \cdot ny}} = \frac{30}{\sqrt{50 \times 30}} = 0.78$$

(3) a still smaller value when nxy < nx and < ny.
For example, let:
ny = 30
nx = 50
nxy = 20
Then:

$$\frac{nxy}{\sqrt{nx \cdot ny}} = \frac{20}{\sqrt{50 \times 30}} = 0.52$$

Therefore, $Cxy = f\frac{nxy}{\sqrt{nx \cdot ny}}$

Let a and b represent any other two answers. We can say that:

$Cxy > Cab$ if $\frac{nxy}{\sqrt{nx \cdot ny}} > \frac{nab}{\sqrt{na \cdot nb}}$, or vice versa.

We can not say how much greater Cxy is than Cab. In order to be able to do so, we must be able to state the relationship between Cxy and $\frac{nxy}{\sqrt{nx \cdot ny}}$.

Assume that a question has been administered twice to the same group of subjects and that the second administration is uninfluenced by the first.

Let:
nx_1' = the number of subjects giving answer x and not answer y on the first administration.
ny_1' = the number of subjects giving y and not x on the first administration.

Then:
$(nx_1' + ny_1')$ = the number of independent answers on the first administration.

Let:
$2nxy_1$ = the number of concomitant answers on the first administration.

T_1 = the total number of answers on the first administration.

Then:

$$T_1 = 2nxy_1 + (nx_1' + ny_1') \text{ -- --------- -------} (1)$$

Similarly let:

$(nx_2' + ny_2')$ = the number of independent answers on the second administration.

$2nxy_2$ = the number of concomitant answers on the second administration.

T_2 = the total number of answers on the second administration.

Then:

$$T_2 = 2nxy_2 + (nx_2' + ny_2') \text{ ----------} (2)$$

Let:

nx_{12}' = the number of subjects giving x on the first administration and either x and not y on the second administration or y and not x on the second administration.

ny_{12}' = the number of subjects giving y on the first administration and either y and not x on the second administration or x and not y on the second administration.

Then:

$(nx_{12}' + ny_{12}')$ = the number of independent answers on one administration which were also independent on the other administration.

Let:

$2nxy_{12}$ = the number of concomitant answers on one administration which were also concomitant on the other administration.

nxy' = the number of concomitant answers on one administration which were independent on the other administration.

Then:

$$\frac{T_1 + T_2}{2} = 2nxy_{12} + (nx_{12}' + ny_{12}') + \frac{nxy'}{1\frac{1}{3}} \text{ ----------} (3)$$

Let:

rc = the reliability of concomitant answers.

ri = the reliability of independent answers.

By analogy with the discussion of concomitance on pages 3 - 7 inclusive:

$$rc = \frac{2nxy_{12}}{\sqrt{2nxy_1 \times 2nxy_2}} \text{ *} \qquad \text{----------(4)}$$

$$ri = \frac{(nx'_{12}+ny'_{12})}{\sqrt{(nx'_1+ny'_1) \times (nx'_2+ny'_2)}} \qquad \text{--------(5)}$$

By substitution from equations 1, 2, and 3, page 8, we have:

$$rc = \frac{\frac{T_1+T_2}{2}-(nx'_{12}+ny'_{12})-\frac{nxy'}{1\frac{1}{3}}}{\sqrt{[T_1-(nx'_1+ny'_1)] \times [T_2-(nx'_2+ny'_2)]}} \qquad \text{-----(6)}$$

$$ri = \frac{\frac{T_1+T_2}{2}-2nxy_{12}-\frac{nxy'}{1\frac{1}{3}}}{\sqrt{(T_1-2nxy_1) \times (T_2-2nxy_2)}} \qquad \text{------(7)}$$

When $nxy' = 0$:

$$2nxy_1 = 2nxy_2 = 2nxy_{12}$$
$$(nx'_1+ny'_1) = (nx'_2+ny'_2) = (nx'_{12}+ny'_{12})$$

By substitution in equations 4, page 9, and equation 5, page 9, we have:

rc = 1, perfect reliability

ri = 1, perfect reliability

Reversibly, it can be shown that when:

ri or rc = 1, $nxy' = 0$

Let it be assumed that:

Neither ri nor rc = 1

Then:

$nxy' > 0$

From equation 6, page 9:

rc increases as $(nx'_1+ny'_1)$ and $(nx'_2+ny'_2)$ decrease.

∴ rc = an inverse $f(nx'+ny')$

From equation 7, page 9:

ri increases as 2nxy and 2nxy decrease.

∴ ri = an inverse f 2nxy

Finally:

$\frac{ri}{rc}$ increases as $\frac{nx'+ny'}{2nxy}$, i.e.

---

* This equation is analogous to one used by Thurstone (11) for a similar purpose.

$$\frac{ri}{rc} = \text{a direct } f\frac{nx' + ny'}{2nxy} \text{ ----------(8)}$$

Let:

W = the weight assigned to any answer in determining the concomitance between any two answers.
Wi = the weight assigned to each independent answer.
Wc = the weight assigned to each concomitant answer.

Let it be assumed that:

$$\frac{Wi}{Wc} \propto \frac{ri}{rc}$$

This means that each answer will be weighted in proportion to its reliability; an answer with high reliability will have a higher weighting than an answer with lower reliability, and vice versa.

Substituting for $\frac{ri}{rc}$ from equation 8, page 10:

$$\frac{Wi}{Wc} = \text{a direct } f\frac{nx' + ny'}{2nxy} \text{ ---------- (9)}$$

Let Q represent the curve of relationship between $\frac{nxy}{\sqrt{nx \cdot ny}}$ and Cxy

The conditions of equation 9 are retained only if:

(1) Q is an accelerated curve with a changing rate of acceleration.
(2) The rate of acceleration between the values 2nxy = 0 and 2nxy = $(nx' + ny')$ is equal and opposite to that between the values 2nxy = $(nx' + ny')$ and 2nxy = a maximum.

The logarithmic curve is just such a curve. But there is an additional factor affecting the Q curve. Neither of the two variables between which the logarithmic curve expresses a relationship ever reach a limit in either direction. In the Q curve, concomitance (Cxy) has reached a limit, a maximum, when nx = ny = nxy (see page 6). At this point, 2nxy = a maximum. Concomitance does not reach a limit in the other direction. For example, let a and b represent any other two answers. We can say that:

Cxy = Cab = a maximum if:

$$\frac{nxy}{\sqrt{nx \cdot ny}} = \frac{nab}{\sqrt{na \cdot nb}} = 1$$

And we can say that Cxy = Cab if:

$$\frac{nxy}{\sqrt{nx \cdot ny}} = \frac{nab}{\sqrt{na \cdot nb}} > 0$$

We can not say Cxy = Cab because:

$$\frac{nxy}{\sqrt{nx \cdot ny}} = \frac{nab}{\sqrt{na \cdot nb}} \text{ if:}$$

$$\frac{nxy}{\sqrt{nx \cdot ny}} = 0 = \frac{nab}{\sqrt{na \cdot nb}}$$

This is true because it is the value where nxy = 0 = nab, i.e. no subject who gave answer x also gave answer y, and no subject who gave answer a also gave answer b. To say that nxy = 0, merely says that the concomitance between x and y is less than a certain value. It does not say how much less. A similar condition holds for a and b. Therefore we can not say that Cab = Cxy because nxy = 0 = nab.

Since concomitance reaches a limit in one direction and not in the other, the rate of approach in the one direction should exceed the rate of approach in the other direction. Therefore, we change the second qualification of the ϕ curve, page 10, to read:

The rate of acceleration between 2nxy = 0 and 2nxy = (nx´+ny´) is less than and opposite to the rate between 2nxy = (nx´+ny´) and 2nxy = a maximum.

The normal probability curve is just such a curve, and we, therefore, assume the ϕ curve to be identical with the normal probability curve. *

We may now outline the steps in determining the scale value of concomitance between any pair of answers x and y. They are as follows:

(1) Determine each nx, ny, and nxy empirically.

(2) Compute the value of $\frac{nxy}{\sqrt{nx \cdot ny}}$

(3) With this value used as the ordinate of a normal probability curve, look up in a table** the corresponding standard deviation.

(4) The standard deviation is Cxy, the scale value of concomitance for the pair of answers x and y. See *, bottom next page.

The same procedure may be applied to all possible pairs of answers in an inventory. Each pair will then have a scale value. A completely concomitant pair will have a scale value of zero, and the scale value of other pairs will be higher as the degree of concomitance is lower.

---

* Therefore, the equation of the ϕ curve is:

$$\frac{nxy}{\sqrt{nx \cdot ny}} = \frac{1}{\sqrt{2\pi}} e^{-\frac{Cxy}{2}}$$

** Use a table in which the maximum ordinate is one.

The scale values are for pairs of answers. A subject, in taking an inventory, selects many answers. These may be combined to give many pairs of answers. A number which is an index of a subject's concomitance on these pairs is called a composite score. A method of determining a subject's composite score is outlined as follows:

(1) Consider only the answers which the subject selected.

(2) Of these answers, determine all the possible pairs. Each pair has a scale value.

(3) Sum the scale values of these pairs and divide by the number of pairs.

---

* The ordinate of a normal probability curve never equals zero. Consequently, there is no standard deviation, no scale value, stated for a zero ordinate. It was necessary to select one. 3.50 was selected for the following reasons: (1) The value selected must be larger than the maximum for any case where $\frac{nxy}{\sqrt{nx \cdot ny}} > 0$. (2) The maximum in this study is 3.09. (3) It must be small enough so as not to weight unduly any individuals composite score. (4) The average scale value ± 4 P.E. of subjects (some of the mental patients) who gave one or more pairs scaled at 3.50 is approximately 3.50.

II A Criterion for the Selection of Pairs

Of the pairs of answers scaled, some may have a higher factor loading of concomitance than others. The following discussion reports the logic involved in developing a criterion for selecting the pairs with the higher factor loadings:

Consider the following example:

Football L I D

Rugby L I D

Suppose that these items have been presented to 100 subjects and that:

(a) 50 subjects answered L for the first item.

50 subjects answered L for the second item.

The 50 subjects who answered L for the first item are the 50 subjects who answered L for the second item.

$$\therefore \frac{nxy}{\sqrt{nx.ny}} \text{ for } L - L = \frac{50}{\sqrt{50X50}} = 1$$

Scale value of L - L = 0

(b) 30 subjects answered I for the first item.

30 subjects answered I for the second item.

The 30 subjects who answered I for the first item are the 30 subjects who answered I for the second item.

$$\therefore \frac{nxy}{\sqrt{nx.ny}} \text{ for } I - I = \frac{30}{\sqrt{30X30}} = 1$$

Scale value of I - I = 0

(c) 20 subjects answered D for the first item.

20 subjects answered D for the second item.

The 20 subjects who answered D for the first item are the 20 subjects who answered D for the second item.

$$\therefore \frac{nxy}{\sqrt{nx \cdot ny}} \text{ for } D - D = \frac{20}{\sqrt{20X20}} = 1$$

Scale value of D - D = 0

Each pair, L - L, I - I, and D - D has a scale value of zero, and each subject has given one of the three pairs. The pairs do not give a scale value discrimination between the subjects. Therefore, they have zero factor loadings.

Another example of zero factor loadings is the following:

Always to work alone L I D

Sometimes to work with others L I D

Suppose that these items have been presented to 100 subjects and that:

(a) 15 subjects answered L for the first item.

15 subjects answered D for the second item.

The 15 subjects who answered L for the first item are the 15 subjects who answered D for the second item.

$$\therefore \frac{nxy}{\sqrt{nx \cdot ny}} \text{ for } L - D = \frac{15}{\sqrt{15X15}} = 1$$

Scale value of L - D = 0

(b) 40 subjects answered I for the first item.

40 subjects answered I for the second item.

The 40 subjects who answered I for the first item are the 40 subjects who answered I for the second item.

$$\therefore \frac{nxy}{\sqrt{nx.ny}} \text{ for } I - I = \frac{40}{\sqrt{40X40}} = 1$$

Scale value of I - I = 0

(c) 45 subjects answered D for the first item.

45 subjects answered L for the second item.

The 45 subjects who answered D for the first item are the 45 subjects who answered L for the second item.

$$\therefore \frac{nxy}{\sqrt{nx.ny}} \text{ for } D - L = \frac{45}{\sqrt{45X45}} = 1$$

Scale value of D - L = 0

Each pair L - D, I - I, and D - L has a scale value of zero, and each subject has given one of the three pairs. The pairs do not give a scale value discrimination between the subjects. Therefore, they have zero factor loadings.

In this example,

(a) (L - D) + (D - L) = a minimum, 0.00

(b) $\frac{nxy}{\sqrt{nx.ny}}$ for L - L = $\frac{0}{\sqrt{15X45}}$ = 0

Scale value of L - L = a maximum, 3.50

(c) $\frac{nxy}{\sqrt{nx.ny}}$ for D - D = $\frac{0}{\sqrt{15X45}}$ = 0

Scale value of D - D = a maximum, 3.50

(d) (L - L) + (D - D) = a maximum, 7.00

In the first example,

(a) (L - L) + (D- D) = a minimum, 0

(b) $\frac{nxy}{\sqrt{nx.ny}}$ for L - D = $\frac{0}{\sqrt{50X20}}$ = 0

Scale value of L - D = a maximum, 3.50

(c) $\frac{nxy}{\sqrt{nx \cdot ny}}$ for D - L = $\frac{0}{\sqrt{20X50}}$ = 0

Scale value of D - L = a maximum, 3.50

(d) (L - D) + (D - L) = a maximum, 7.00

In either example, (L - L) + (D - D) - (L - D) - (D - L) = a maximum numerical value, of - 7.00 in the first example, of - 7.00 in the second example. When (L - L) + (D - D) - (L - D) - (D - L) = a maximum numerical value, the factor loadings of the pairs of answers for the items involved are zero. It was assumed: When (L - L) + (D - D) - (L - D) - (D - L) = a small numerical value, the factor loading is higher than when (L - L) + (D - D) - (L - D) - (D - L) = a larger numerical value, i.e. that the Criterion is completely satisfied when its value is zero and is less satisfied as its value is larger.

III A Refined Method of Scoring

Mental hospital patients were included in a study which used the method of scoring already outlined in this Appendix. Their inclusion suggested a further refinement of the method of obtaining an individuals score of Concomitance. The following discussion reports the statistical development of the method.

There are nine possible combinations of answers for any two items: L - L, L - I, L - D, I - L, I - I, I - D, D - L, D - I, and D - D in the case

of the Blank and Y - Y, Y - N, Y - ?, N - Y, N - N, N - ?, ? - Y, ? - N, ? - ? in case of the Inventory. All college students gave approximately the same number of each combination. For example, no college student gave many more D - D combinations than did other college students. The number of each combination given showed much greater variations for mental patients. Some mental patients, for example, gave practically all D - D combinations; while others gave practically all L - L combinations. The average scale value of all D - D combinations is greater than the average of all L - L combinations. A concomitance score of 1.23 on D - D combinations may not equal a concomitance score of 1.23 on L - L combinations. Also, an average concomitance of 1.23 on 10 D - D combinations may not equal an average concomitance of 1.23 on 40 D - D combinations.

A method of scoring was developed which is adaptable to variations in the number of each combination given. The method is as follows:

An average score was determined for each subject on each combination. For example, a subject's average score on D - D combinations is the average of the scale values of the D - D combinations which he gave. The number of times each combination was given by each individual was recorded.

Let:

$X_{1,2,3,\cdots n}$ = Average scores of any combination

$Y_{1,2,3,\cdots n}$ = Number of times that combination was given by each individual.

y = Y in deviation form.

x = X in deviation form.

r = correlation between x and y.

$x' = r\frac{\sigma x}{\sigma y} y$, the regression equation of x on y.

$x'' = \frac{x - x}{\sigma x}$

By substitution:

$$x'' = \frac{x - r\frac{\sigma x}{\sigma y} y}{\sigma x'}$$

Since $\sigma x' = \sigma x \sqrt{1 - r^2}$ (the usual formula for $\sigma x'$):

$$x'' = \frac{x - r\frac{\sigma x}{\sigma y} y}{\sigma x \sqrt{1 - r^2}}$$

r, σx, and σy were determined for each combination, using the variables of only college students. The values of r, σx, and σy are shown on page 28.

x'' was computed for each subject, students and patients, on each combination. In computing x'', average $y + 3\sigma y$ was used for all values of y greater than average $y + 3\sigma y$.* x'' gives the number of standard deviations a subject's X score is from the mean X score of subjects who gave the same number of combinations as did he.** On a blank for which at least one of each combination of answers was given, there are nine x'' scores. Some subjects did not give all possible combinations. For example, some subjects gave no L - I combinations. Only four x'''s are possible on the Inventory. All combinations with ? as a number of the combination were omitted, because such combinations by college students were so few as to make the values of r, σx, and σy quite unreliable.

To obtain a composite score for any subject on the Blank:

(1) Each of his x'''s was multiplied by its corresponding Y to give a Yx'' for each combination of answers, thus a Yx'' score for L - L, a Yx'' score for L - I, a Yx'' score for L - D, etc.

---

* This was done because after y = average $y + 3\sigma y$, the possible increase of average x with additional increases in average y was very slight. In other words:

$$x = \frac{\Sigma \text{ scale values}}{N \text{ of scale values}} = \text{approximately } \frac{\Sigma \text{ combinations} + \text{additional scale values}}{N + 1}$$

** Or in a case of $y >$ average $y + x\sigma y$, x'' gives the number of standard deviations a subjects X score is from the mean X score of subjects who gave average $y + 3\sigma y$ combinations.

(2) These scores were summed and divided by N, the number of pairs of answers given by that subject, to give $\frac{Yx''}{N}$.

$\frac{Yx''}{N}$ is the composite score. Step (1) was necessary in order to give each pair of answers equal weight. Y in some cases was much larger for one combination than for another combination. Step two was necessary because some subjects failed to answer all items, thus N varies from blank to blank.

A $\frac{Yx''}{N}$ score was determined for each subject on the Blank and on the Inventory. Scores on the Blank were correlated with scores on the Inventory.

Scale Values for Pairs of Answers on the Strong Vocational Interest Blank

Explanation

The items in each part of the Blank were numbered from above down: 1, 2, 3----$_n$. In the following tables: Column N gives the pairs of items by number. Column V gives the numerical value of the Criterion for the Selection of Pairs (p.16) for each pair. Column T gives the number of the test (p.16) in which each item was placed. Column L - L gives the scale values (p.15) of L - L answers for each pair of items, column L - I for L - I answers, column L - D for L - D answers, etc. In the top row of the next page, for example, items one and two are paired. 0.42 is the value of the Criterion for the pair. The pair was placed in test two. $L_1 - L_2$ answers have a scale value of 1.29, $L_1 - I_2$ answers of 1.32, $L_1 - D_2$ answers of 1.85, $I_1 - L_2$ answers of 1.45, $I_1 - I_2$ answers of 1.37, $I_1 - D_2$ answers of 1.60, $D_1 - L_2$ answers of 1.49, $D_1 - I_2$ answers of 1.57, and $D_1 - D_2$ answers 1.64. For items two and three, the scale value of $L_2 - L_3$ answers is 1.47, of $L_2 - I_3$ answers is 1.39, of $L_2 - D_3$ answers is 1.34, of $I_2 - L_3$ answers is 1.41, etc.

OCCUPATIONS - PART Ia

			L			I			D		
N	V	T	L	I	D	L	I	D	L	I	D
1& 2	.42	2	1.28	1.32	1.85	1.45	1.37	1.60	1.49	1.57	1.64
2& 3	.13	1	1.47	1.39	1.34	1.41	1.32	1.51	1.82	1.55	1.82
3& 4	.12	1	1.43	1.62	1.55	1.55	1.28	1.41	1.39	1.85	1.39
4& 5	.21	2	1.49	1.45	1.47	1.69	1.34	1.64	1.55	1.49	1.32
5& 6	.98	4	1.41	1.60	1.69	1.43	1.19	1.74	1.79	1.62	1.09
6& 7	.43	2	1.51	1.43	1.67	1.35	1.39	1.64	1.64	1.39	1.37
7& 8	.72	3	1.71	1.55	1.34	1.60	1.34	1.30	2.25	1.88	1.16
8& 9	.50	3	1.53	1.95	2.06	1.35	1.49	2.10	1.23	1.28	1.26
9&10	.38	2	1.19	1.28	1.64	1.47	1.35	1.67	2.06	1.98	1.13
10&11	.47	3	1.77	1.51	1.26	1.67	1.30	1.45	1.43	1.71	1.39
11&12	1.33	4	1.35	1.64	1.88	1.35	1.51	1.62	1.71	1.60	.98
12&13	1.73	4	1.18	1.49	1.71	1.79	1.45	1.53	2.06	1.85	.86
13&14	1.30	4	1.11	2.31	2.45	1.34	1.64	2.31	1.35	1.09	1.39
14&15	.42	2	1.37	1.25	1.26	1.79	1.32	1.49	2.15	1.82	1.62
15&16	2.66	5	.96	1.88	2.06	1.88	1.03	1.45	2.37	1.98	.81
16&17	.54	3	1.39	1.82	1.95	1.77	1.26	1.67	1.35	1.25	1.37
17&18	1.00	4	1.30	1.49	1.82	1.41	1.18	1.62	1.71	1.85	1.23
18&19	.21	2	1.79	1.35	1.34	1.60	1.43	1.35	1.88	1.82	1.21
19&20	1.08	4	1.53	1.64	2.25	1.62	1.19	1.88	1.49	1.30	1.13
20&21	.30	2	1.55	1.60	1.53	1.39	1.19	1.51	1.67	1.67	1.35
21&22	2.40	5	.96	1.77	1.79	1.98	.93	1.71	2.37	1.88	.86
22&23	.06	1	1.64	1.67	1.60	1.51	1.28	1.57	1.28	1.67	1.30
23&24	1.66	4	1.09	1.51	1.79	1.67	1.19	1.85	1.95	1.69	.99
24&25	.71	3	1.49	1.30	1.88	1.64	1.18	1.74	1.60	1.53	1.28
25&26	.20	2	2.10	1.34	1.53	1.53	1.39	1.13	1.98	2.06	1.21
26&27	.84	3	1.39	2.25	2.02	1.43	1.41	1.85	1.39	1.23	1.18
27&28	1.14	4	1.13	1.55	1.88	1.26	1.47	1.85	1.71	1.51	1.32
28&29	.23	2	1.67	1.39	1.09	1.88	1.37	1.43	1.74	2.02	1.39
29&30	.25	2	2.10	1.51	1.85	1.55	1.30	1.74	1.49	1.45	.99
30&31	.13	1	1.43	1.91	1.62	1.41	1.25	1.79	1.39	1.37	1.45
31&32	.02	1	1.51	1.37	1.37	1.47	1.28	1.60	1.55	1.95	1.43
32&33	.33	2	1.67	1.41	1.47	1.41	1.25	1.91	1.30	1.67	1.43
33&34	.44	3	1.23	1.49	1.79	1.09	1.60	2.02	1.45	1.71	1.57
34&35	.55	3	1.08	1.18	1.55	1.71	1.37	1.74	1.79	1.82	1.71
35&36	2.01	4	1.53	1.45	1.25	2.65	1.45	1.06	3.50	2.80	1.21
36&37	1.33	4	1.69	2.02	2.45	1.88	1.34	1.74	1.41	1.39	.84

OCCUPATIONS - PART Ib

			L			I			D		
N	V	T	L	I	D	L	I	D	L	I	D
1&2	2.28	5	.94	1.53	2.10	1.47	1.19	2.37	1.95	1.95	.83
2&3	.21	2	1.64	1.30	1.34	1.67	1.69	1.30	1.98	1.49	1.47
3&4	.10	1	2.15	1.69	1.57	1.57	1.39	1.43	1.69	1.53	1.01
4&5	.02	1	1.88	1.69	1.69	1.77	1.45	1.45	1.35	1.39	1.14
5&6	3.25	5	.96	1.62	2.37	1.82	.96	1.88	2.37	1.95	.63
6&7	.49	3	1.77	1.57	1.57	1.47	1.26	1.77	1.18	1.51	1.47
7&8	.66	3	1.30	1.32	1.77	1.21	1.45	1.88	1.64	1.67	1.45
8&9	1.15	4	1.23	1.30	1.57	1.55	1.30	1.55	2.02	2.15	1.21
9&10	3.17	5	.74	1.91	2.19	1.91	.79	1.95	2.37	2.25	.65
10&11	2.25	5	1.18	1.35	2.15	1.88	.93	2.15	1.95	2.15	.67
11&12	.03	1	1.53	1.62	1.71	1.21	1.41	1.67	1.32	1.64	1.47
12&13	2.40	5	1.34	1.16	1.37	3.50	1.43	1.34	3.50	3.09	1.13
13&14	1.64	4	1.53	1.79	2.19	1.69	1.45	1.39	1.91	1.34	.93
14&15	3.08	5	1.11	3.50	3.50	1.26	1.26	2.54	1.67	1.23	.98
15&16	.68	3	1.43	1.37	1.45	1.34	1.45	1.60	1.85	2.02	1.19
16&17	.65	3	1.53	1.47	1.47	1.91	1.21	1.64	1.74	1.74	1.03
17&18	2.24	5	1.49	1.57	1.91	1.85	1.06	1.67	2.65	1.64	.81
18&19	1.16	4	1.69	1.74	2.54	1.34	1.32	1.60	1.39	1.57	1.08
19&20	.47	3	1.47	1.34	1.57	1.77	1.35	1.53	1.62	1.60	1.25
20&21	.69	3	1.51	1.74	1.57	1.60	1.16	1.51	1.69	1.79	1.06
21&22	.30	2	1.49	1.85	1.57	1.35	1.60	1.62	1.43	1.43	1.21
22&23	.46	3	1.74	1.25	1.43	2.02	1.34	1.69	1.91	1.51	1.14
23&24	.42	2	2.02	1.62	2.06	1.47	1.19	1.45	1.51	1.57	1.13
24&25	.42	2	1.95	1.55	1.45	1.88	1.28	1.35	1.98	1.64	1.06
25&26	.77	3	1.67	2.15	2.10	1.35	1.30	1.95	1.43	1.28	1.09
26&27	1.03	4	1.35	1.49	1.53	1.82	1.28	1.35	1.98	1.85	1.13
27&28	1.38	4	1.43	1.60	2.31	1.43	1.35	1.79	1.64	1.25	1.14
28&29	2.58	5	1.04	1.69	2.31	1.47	.96	1.95	2.10	2.10	.79
29&30	1.47	4	1.39	1.23	1.79	1.57	1.21	1.53	2.10	1.85	1.03
30&31	2.91	5	.96	2.02	2.80	1.53	.86	2.06	1.85	1.95	.78
31&32	.18	2	1.53	1.55	1.32	1.49	1.34	1.51	1.71	1.64	1.32
32&33	.49	3	1.45	1.57	1.71	1.34	1.35	1.98	1.37	1.71	1.14
33&34	1.19	4	1.37	1.21	1.51	1.79	1.39	1.53	2.06	2.10	1.01
34&35	.54	3	1.53	1.71	1.71	2.06	1.08	1.64	1.49	1.47	1.13
35&36	.88	3	1.43	1.71	1.98	1.30	1.19	1.85	1.47	1.69	1.14
36&37	1.49	4	.93	1.71	1.91	1.74	1.01	1.88	1.67	1.85	1.16

AMUSEMENTS - PART II

			L			I			D		
N	V	T	L	I	D	L	I	D	L	I	D
1&2	1.20	4	.89	1.47	1.95	1.26	1.71	1.56	1.91	1.79	1.77
2&3	2.43	5	.59	1.71	2.45	1.71	1.43	1.57	2.06	1.47	1.49
3&4	.75	3	.83	1.35	1.95	1.34	1.74	2.25	1.64	2.19	2.02
4&5	1.93	4	.61	1.69	2.45	1.37	1.71	3.50	1.88	2.37	1.79
5&6	2.74	5	.76	1.16	1.67	1.77	2.02	1.49	3.50	3.50	1.67
6&7	.79	3	1.14	1.19	1.51	1.88	1.30	1.64	1.95	1.82	1.53
7&8	1.23	4	1.19	1.60	1.85	1.57	1.09	1.57	1.85	1.62	1.28
8&9	1.60	4	1.38	1.28	2.02	1.49	1.16	1.57	1.95	1.38	.99
9&10	1.12	4	1.39	1.51	1.95	1.32	1.34	1.57	1.74	1.60	1.18
10&11	1.61	4	1.03	1.74	2.15	1.32	1.35	1.88	1.67	1.60	1.18
11&12	1.65	4	.99	1.30	1.74	1.82	1.35	1.55	2.06	1.91	1.16
12&13	1.96	4	1.21	1.51	1.82	1.49	1.18	1.91	1.69	1.49	1.34
13&14	.10	1	1.64	1.19	1.57	1.25	1.34	1.62	1.77	1.62	1.60
14&15	1.03	4	1.30	1.53	1.77	1.30	1.25	1.60	1.88	1.64	1.32
15&16	.20	2	1.26	1.49	1.67	1.26	1.39	1.82	1.43	1.69	1.64
16&17	1.35	4	1.30	1.08	1.71	1.82	1.18	1.79	2.15	1.31	1.21
17&18	.53	3	1.79	1.69	1.47	1.47	1.08	1.39	2.15	1.69	1.30
18&19	.43	2	1.67	1.85	1.64	1.41	1.23	1.60	1.55	1.67	1.09
19&20	.54	3	1.47	1.49	1.62	1.55	1.34	1.74	1.60	1.43	1.21
20&21	.65	3	1.34	1.60	1.85	1.34	1.21	1.98	1.53	1.47	1.39
21&22	2.41	5	.86	1.77	2.31	1.41	1.06	2.19	2.10	1.62	1.41
22&23	3.50	5	.67	1.71	2.54	1.82	.89	1.32	2.45	2.25	.91
23&24	.60	3	1.08	1.37	1.60	1.71	1.08	1.82	1.77	1.82	1.69
24&25	1.70	4	1.21	1.62	1.39	2.02	1.21	1.18	2.80	2.06	1.28
25&26	.64	3	1.49	1.79	2.02	1.53	1.32	1.85	1.34	1.32	1.23
26&27	1.48	4	.83	1.45	1.91	1.55	1.26	1.49	1.74	1.62	1.34
27&28	.28	2	1.43	1.47	1.47	1.49	1.35	1.45	1.71	1.43	1.57
28&29	1.34	4	1.37	1.53	1.57	1.98	1.13	1.41	2.15	1.91	1.01
29&30	1.91	4	1.39	2.06	3.50	1.23	1.47	2.02	1.25	1.25	1.45
30&31	1.33	4	.94	1.39	1.82	1.55	1.16	1.95	1.82	2.19	1.37
31&32	3.45	5	.70	2.25	3.50	1.30	1.23	2.15	2.02	1.43	1.37
32&33	.59	3	.78	1.39	1.77	1.37	1.57	2.54	1.79	3.50	2.19
33&34	2.20	5	.55	1.88	2.15	1.51	1.34	2.45	2.15	1.82	1.55
34&35	.06	1	.91	1.14	1.45	1.62	1.82	1.79	1.85	2.54	2.45
35&36	.83	3	1.47	1.16	1.34	1.91	1.39	1.43	2.45	1.64	1.49
36&37	2.08	5	1.39	1.95	1.91	1.45	.86	1.82	2.25	2.15	.69

SCHOOL SUBJECTS - PART III

			L			I			D		
N	V	T	L	I	D	L	I	D	L	I	D
1&2	.62	3	1.35	1.23	1.26	1.74	1.35	1.98	2.06	1.57	1.35
2&3	1.01	4	1.28	1.91	2.10	1.14	1.37	1.77	1.45	1.69	1.26
3&4	.22	2	1.41	1.18	1.28	1.49	1.53	1.91	1.62	1.57	1.71
4&5	.33	2	1.53	1.35	1.69	1.60	1.09	1.71	1.60	1.60	1.43
5&6	.63	3	1.77	1.32	1.77	1.28	1.19	1.49	1.91	1.71	1.28
6&7	.25	2	1.57	1.60	1.55	1.55	1.04	1.71	1.57	1.60	1.34
7&8	.19	2	1.71	1.49	1.53	1.62	1.08	1.53	1.67	1.69	1.30
8&9	1.54	4	1.32	1.77	2.45	1.21	1.19	1.91	1.45	1.98	1.04
9&10	.37	2	1.25	1.11	1.95	1.32	1.55	2.65	1.34	1.82	1.67
10&11	.93	3	1.09	1.26	1.77	1.35	1.35	1.62	2.02	2.02	1.77
11&12	.33	2	1.08	1.43	1.79	1.35	1.28	1.85	1.64	1.71	2.02
12&13	.74	3	.96	1.53	1.67	1.47	1.32	1.53	1.82	1.98	1.79
13&14	.87	3	.88	1.64	1.91	1.39	1.49	1.88	1.55	1.67	1.71
14&15	2.46	5	1.11	1.03	1.67	1.88	1.30	1.95	3.50	1.64	1.60
15&16	1.10	4	1.30	1.57	1.98	1.06	1.43	1.39	1.91	1.82	1.49
16&17	.21	2	1.06	1.41	1.69	1.30	1.85	1.79	1.41	1.51	2.25
17&18	.72	3	1.34	1.11	1.25	1.88	1.88	1.21	2.10	2.45	1.49
18&19	2.00	4	1.09	2.19	2.45	1.34	1.28	2.65	1.60	1.35	.96
19&20	1.32	4	.99	1.60	2.10	1.19	1.60	2.19	1.60	1.55	1.39
20&21	.04	1	1.09	1.28	1.34	1.37	1.71	1.79	1.62	2.25	1.91
21&22	.99	4	1.13	1.26	1.67	1.45	1.62	1.69	1.98	1.37	1.53
22&23	2.58	5	.88	1.67	1.95	1.77	.94	1.71	2.54	1.79	1.03
23&24	.99	4	1.21	1.57	1.77	1.43	1.26	1.51	1.71	1.77	1.28
24&25	.36	2	1.11	1.62	1.82	1.43	1.37	1.71	1.82	1.71	1.87
25&26	1.85	4	.99	1.28	1.69	1.71	1.30	1.79	2.45	1.69	1.30
26&27	1.47	4	1.30	1.26	1.88	1.69	1.21	1.39	2.19	1.67	1.30
27&28	1.53	4	1.35	1.67	2.31	1.23	1.14	2.15	1.41	1.45	.84
28&29	.60	3	1.04	1.45	1.77	1.21	1.39	1.57	2.02	1.91	2.15
29&30	.23	2	1.14	1.25	1.49	1.51	1.47	1.62	1.62	2.02	1.74
30&31	.27	2	1.19	1.28	2.02	1.18	1.57	2.54	1.32	1.82	1.88
31&32	.89	3	.98	1.21	1.64	1.88	1.06	2.10	2.02	2.37	1.79
32&33	.06	1	1.21	1.51	1.71	1.14	1.32	1.64	1.71	1.85	2.15
33&34	.01	1	1.41	1.14	1.35	1.53	1.45	1.57	1.69	1.95	1.64
34&35	.29	2	1.82	1.34	1.60	1.69	1.01	1.91	1.79	1.47	1.28
35&36	2.32	5	1.43	1.77	3.50	1.32	.93	1.88	1.60	1.62	1.35
36&37	.52	3	1.23	1.62	1.60	1.21	1.19	1.62	1.79	1.98	1.64

ACTIVITIES - PART IV

			L			I			D		
N	V	T	L	I	D	L	I	D	L	I	D
1&2	2.45	5	1.03	1.41	2.19	1.71	1.01	1.98	2.15	1.85	.86
2&3	2.71	5	1.13	1.51	2.80	1.30	1.08	1.91	1.88	2.06	.84
3&4	2.88	5	.78	1.91	2.25	1.55	.91	2.19	2.15	2.37	.74
4&5	1.81	4	1.21	1.11	1.69	2.02	1.19	1.69	2.37	2.06	1.04
5&6	2.00	4	1.28	1.82	2.80	1.03	1.34	2.10	1.57	1.69	1.09
6&7	1.12	4	1.03	1.35	1.71	1.53	1.55	1.62	1.91	1.71	1.47
7&8	1.38	4	1.06	1.35	2.31	1.55	1.26	1.60	1.64	1.67	1.51
8&9	1.22	4	1.30	1.18	1.74	1.51	1.34	1.35	2.15	2.02	1.37
9&10	2.88	5	1.01	1.49	2.15	1.98	.99	1.55	2.65	1.82	.91
10&11	.72	3	1.51	1.85	1.71	1.11	1.62	1.53	1.14	1.5[illegible]	2.06
11&12	.86	3	1.11	1.13	1.51	1.74	1.74	1.47	1.95	1.85	1.49
12&13	2.47	5	.84	1.95	1.77	1.98	.93	1.67	2.45	1.91	.91
13&14	2.41	5	.91	1.91	2.65	1.79	.86	2.31	1.55	2.82	.88
14&15	1.44	4	.99	.74	1.82	1.62	1.32	1.45	1.82	1.85	1.21
15&16	1.50	4	1.09	1.34	1.88	1.95	1.34	1.51	1.82	1.69	1.11
16&17	.79	3	1.21	1.60	2.10	1.35	1.35	1.64	1.39	1.53	1.49
17&18	.79	3	1.11	1.28	1.67	1.79	1.39	1.34	1.85	1.67	1.62
18&19	1.63	4	1.03	1.69	2.06	1.69	.91	1.98	1.64	1.95	1.04
19&20	.31	2	1.35	1.30	1.69	1.11	1.55	1.88	1.37	1.74	2.02
20&21	3.29	5	.61	1.62	2.25	2.19	.89	1.71	2.54	2.15	.99
21&22	1.15	4	.99	1.47	2.19	1.21	1.47	1.88	1.64	1.77	1.69
22&23	2.80	5	.65	1.67	2.54	1.47	1.34	1.64	2.45	1.67	1.45
23&24	2.59	5	.59	1.77	2.37	1.55	1.30	1.98	2.06	1.93	1.35
24&25	1.95	4	.70	1.35	1.95	1.64	1.55	1.77	2.15	2.31	1.45
25&26	.72	3	1.09	1.23	1.39	1.64	1.51	1.60	1.95	2.31	1.53
26&27	.98	4	1.32	1.35	1.62	1.64	1.30	1.62	1.91	1.57	1.23
27&28	.10	1	1.41	1.57	1.85	1.39	1.28	1.53	1.30	1.57	1.64
28&29	.06	1	1.71	1.30	1.23	1.79	1.21	1.53	1.85	1.77	1.43
29&30	.17	2	1.60	1.91	1.98	1.26	1.37	1.57	1.28	1.43	1.49
30&31	1.72	4	1.03	1.37	1.69	1.82	1.26	1.55	2.25	1.71	1.19
31&32	1.04	4	1.23	1.60	2.06	1.34	1.25	1.91	1.51	1.60	1.30
32&33	.90	3	1.14	1.37	1.62	1.57	1.19	1.74	1.85	1.79	1.43
33&34	1.47	4	.99	1.69	2.37	1.32	1.34	1.60	1.71	1.43	1.62
34&35	1.67	4	1.08	1.19	1.82	1.69	1.23	1.64	2.25	1.91	1.32
35&36	2.05	5	1.03	1.62	2.02	1.60	.93	1.79	2.10	1.95	1.04
36&37	.22	2	1.32	1.45	1.79	1.28	1.35	1.57	1.49	1.67	1.74

PECULIARITIES OF PEOPLE - PART V

			L			I			D		
N	V	T	L	I	D	L	I	D	L	I	D
1&2	1.11	4	.94	1.08	1.45	1.67	1.60	2.65	1.88	3.50	3.50
2&3	.62	3	.89	1.91	2.02	1.04	1.71	2.31	1.51	2.54	2.02
3&4	1.32	4	1.69	1.13	.76	1.82	1.79	2.02	1.98	1.95	2.37
4&5	1.95	4	1.49	1.85	1.82	2.31	1.57	1.18	2.45	1.60	.83
5&6	2.25	5	1.26	3.50	2.15	2.06	1.71	1.45	2.10	1.26	.74
6&7	.07	1	1.69	2.65	2.80	1.37	1.60	2.02	.81	1.37	1.85
7&8	1.40	4	1.79	1.45	.72	2.06	1.18	1.77	1.69	2.06	2.02
8&9	.73	3	1.60	2.54	3.50	1.16	1.67	2.45	.81	1.64	1.38
9&10	.93	3	.89	1.26	1.23	2.65	1.49	1.62	2.54	2.45	1.95
10&11	.14	1	1.79	1.39	1.23	1.91	1.43	1.39	1.85	1.39	1.43
11&12	.14	2	1.51	2.19	2.37	1.32	1.19	2.19	1.16	1.26	1.88
12&13	.51	3	1.19	1.25	1.53	1.64	1.23	1.35	1.69	2.37	2.54
13&14	.45	3	1.16	1.77	1.82	1.19	1.26	2.10	1.41	1.74	1.62
14&15	1.02	4	1.67	1.35	.91	2.06	1.16	1.71	1.95	1.95	1.69
15&16	1.27	4	1.45	2.02	2.02	1.69	1.23	1.41	1.71	1.45	1.01
16&17	.30	2	1.51	1.71	1.77	1.62	1.26	1.67	1.51	1.14	1.47
17&18	.97	3	2.02	1.69	1.19	2.80	.89	1.47	1.53	1.51	1.67
18&19	1.12	4	1.77	2.45	1.98	.86	1.57	2.45	1.04	1.77	2.37
19&20	.61	3	1.35	.83	1.06	2.10	2.02	1.45	3.50	2.45	2.10
20&21	1.44	4	1.85	1.91	2.25	1.60	1.26	1.18	2.10	1.47	1.06
21&22	.77	3	1.57	2.37	1.38	1.11	1.69	3.50	.94	1.39	2.02
22&23	.65	3	1.25	.88	1.47	1.85	1.41	1.88	2.45	2.15	2.02
23&24	1.54	4	1.28	1.47	2.06	1.79	.96	1.30	2.06	1.95	1.30
24&25	.14	2	1.71	1.67	1.57	1.19	1.13	2.06	1.57	1.37	1.57
25&26	1.89	4	1.19	1.48	1.69	1.79	.96	1.60	2.80	1.67	1.41
26&27	2.03	5	1.30	1.55	1.77	2.54	.96	1.26	2.65	2.02	1.09
27&28	1.14	4	1.45	2.80	2.54	1.45	.98	2.19	1.37	1.37	1.23
28&29	2.74	5	.91	1.55	2.37	1.95	.81	1.85	2.31	1.88	1.03
29&30	.69	3	1.77	1.55	1.39	1.71	1.21	1.11	2.37	2.19	1.30
30&31	.07	1	2.45	1.79	1.71	2.10	.99	2.02	1.74	1.32	.93
31&32	1.75	4	1.23	2.37	1.98	2.25	.78	1.77	2.06	1.39	1.06
32&33	2.43	5	1.13	2.37	1.95	2.31	.51	1.88	2.37	2.06	.76
33&34	1.14	4	1.43	2.80	2.25	1.53	.83	1.77	1.64	1.41	1.32
34&35	3.13	5	.83	1.77	2.10	3.09	.55	1.82	2.65	2.19	.79
35&36	1.30	4	1.26	1.98	1.82	2.10	.88	1.34	2.06	1.55	1.32
36&37	.84	3	1.85	1.67	1.95	1.67	1.25	1.11	1.85	1.74	1.11

Scale Values for Pairs of Answers on the Bernreuter Personality Inventory

Explanation

The items in the Inventory are numbered from 1 - 125. In the following tables: Column N gives the pairs of items by number. Column V gives the numerical value of the Criterion for the Selection of Pairs (p.20) for each pair. Column Y - Y gives the scale value (p.20) of Y - Y answers for each pair of items, column Y - N for Y - N answers, column Y - ? for Y - ? answers, etc. In the top row of the next page, for example, items one and two are paired. 0.17 is the value of the Criterion for the Selection of Pairs, for this pair. $Y_1 - Y_2$ answers have a scale value of 1.11, $Y_1 - N_2$ answers of 1.30, $Y_1 - ?_2$ answers of 2.54, $N_1 - Y_2$ answers of 1.01, $N_1 - N_2$ answers of 1.37, $N_1 - ?_2$ answers of 2.02, $?_1 - Y_2$ answers of 1.74, $?_1 - N_2$ answers of 2.10, and $?_1 - ?_2$ answers of 1.88. For items two and three, the scale value of $Y_2 - Y_3$ answers is 0.76, of $Y_2 - N_3$ answers if 1.45, of $Y_2 - ?_3$ answers is 1.57, etc.

		Y			N			?		
N	V	Y	N	?	Y	N	?	Y	N	?
1&2	.17	1.11	1.30	2.54	1.01	1.37	2.02	1.74	2.10	1.88
2&3	.03	.78	1.45	1.57	1.18	1.82	2.45	1.98	3.50	1.49
3&4	.22	.81	1.25	1.91	1.49	1.74	3.50	1.60	2.15	3.50
4&5	.28	.84	1.32	1.71	1.19	1.95	2.02	2.15	2.37	2.15
5&6	.06	.78	1.34	2.15	1.35	1.85	3.50	1.74	1.88	3.50
6&7	.35	1.37	.78	1.62	2.31	1.37	1.49	3.50	2.10	3.50
7&8	.31	1.57	1.71	2.54	1.13	.96	1.79	1.74	1.57	1.91
8&9	.29	1.60	1.04	2.02	1.71	.86	2.25	1.91	1.79	3.50
9&10	1.22	1.64	1.43	2.45	1.83	.51	1.85	2.15	2.37	1.67
10&11	.83	2.25	1.60	2.54	.86	1.04	1.57	2.15	1.98	1.88
11&12	.20	1.35	1.08	2.15	1.55	1.08	2.10	2.06	1.64	1.74
12&13	.27	1.47	1.47	1.85	1.25	.98	1.51	2.65	1.79	1.98
13&14	.13	1.57	1.16	2.19	1.32	1.64	1.95	1.83	1.43	1.98
14&15	.23	1.18	1.74	2.65	.93	1.26	1.74	1.95	2.15	1.95
15&16	.33	.81	1.32	2.54	1.35	1.53	2.06	1.85	2.02	1.98
16&17	.12	1.11	1.03	1.64	1.43	1.47	1.85	2.15	2.19	3.50
17&18	.59	1.11	1.39	1.95	1.39	1.08	1.95	1.91	1.77	1.71
18&19	.07	1.64	.99	2.15	1.57	.90	2.02	1.98	1.69	3.50
19&20	.08	1.62	1.51	2.54	1.01	.98	1.69	1.98	2.31	2.19
20&21	.08	1.26	1.18	2.45	1.19	1.19	2.15	1.79	1.95	3.50
21&22	.03	1.28	1.14	1.85	1.35	1.18	1.49	1.85	3.50	2.15
22&23	.07	1.49	1.23	1.85	1.37	1.04	1.95	1.91	1.51	2.25
23&24	.30	1.41	1.37	2.15	1.26	.94	1.74	1.95	2.02	1.74
24&25	.52	1.28	1.41	1.85	.67	1.32	1.88	1.77	1.98	1.95
25&26	.04	1.21	1.03	2.10	1.47	1.25	2.19	2.45	1.74	1.53
26&27	.49	1.30	1.41	1.85	1.32	.94	1.74	1.98	1.91	2.31
27&28	.38	1.34	1.23	2.15	1.47	.98	1.51	2.37	1.95	1.51
28&29	.18	1.74	1.26	2.06	1.49	.83	2.10	1.85	1.64	2.02
29&30	.08	1.49	1.64	2.19	.88	1.11	1.88	1.93	2.10	2.15
30&31	.02	.99	1.30	1.85	1.18	1.51	1.98	1.91	3.50	1.62
31&32	.46	1.11	1.09	1.67	1.71	1.23	2.02	2.45	1.62	1.98
32&33	.12	1.23	1.51	2.15	1.01	1.41	1.57	1.69	2.10	1.74
33&34	.13	1.14	1.04	1.82	1.60	1.37	2.02	2.02	1.67	1.64
34&35	.33	1.43	1.21	2.10	1.11	1.21	1.91	1.95	1.67	2.10
35&36	.10	1.23	1.23	2.45	1.13	1.23	2.15	1.98	1.85	3.50
36&37	.07	.98	1.45	1.95	1.01	1.55	1.98	2.02	3.50	3.50
37&38	.04	.91	1.13	1.60	1.45	1.71	2.10	2.15	2.02	1.91

		Y			N			?		
N	V	Y	N	?	Y	N	?	Y	N	?
38&39	.10	1.25	1.04	2.02	1.45	1.34	1.95	1.67	1.71	1.98
39&40	.28	1.23	1.30	3.50	.99	1.34	2.02	2.02	1.85	1.98
40&41	.73	.78	1.71	1.91	1.25	1.45	1.62	2.31	3.50	1.79
41&42	.06	.91	1.23	1.60	1.41	1.79	2.65	1.82	1.85	1.74
42&43	.35	1.11	1.04	1.64	1.34	1.62	1.71	1.95	1.71	1.77
43&44	.07	1.51	1.03	1.95	1.71	1.16	1.74	1.85	1.53	1.82
44&45	.26	1.57	1.53	2.15	1.13	.88	2.25	1.85	1.77	1.77
45&46	.10	1.37	.88	1.82	1.47	.86	1.88	2.25	1.98	2.25
46&47	.39	1.67	1.23	2.37	1.67	.84	1.43	1.82	1.82	2.25
47&48	.01	1.77	1.51	2.37	1.14	.89	1.95	2.15	1.47	2.37
48&49	.20	1.30	1.51	1.88	1.08	1.09	1.88	1.95	2.15	3.50
49&50	.01	1.30	1.08	1.95	1.39	1.16	2.19	1.95	1.91	1.95
50&51	.13	1.55	1.21	1.91	1.41	.94	1.69	1.74	2.10	3.50
51&52	.34	1.49	1.41	1.95	.93	1.19	2.10	1.95	1.95	1.51
52&53	.35	1.25	1.13	1.71	1.1	1.41	1.38	1.83	1.98	1.95
53&54	.14	1.34	1.14	1.77	1.47	1.13	1.77	2.15	1.60	2.25
54&55	.41	1.43	1.34	2.67	.94	1.26	1.82	1.67	2.15	1.69
55&56	.38	.89	1.53	1.95	1.19	1.55	1.77	1.71	2.15	2.37
56&57	.23	1.64	.67	1.88	2.06	1.32	2.25	2.45	1.71	2.02
57&58	.44	1.95	1.64	2.37	.88	1.01	1.77	1.79	2.10	3.50
58&59	.06	1.13	1.34	1.67	1.14	1.41	1.95	1.98	2.02	2.06
59&60	.13	1.83	1.04	2.15	1.53	1.21	3.50	1.83	1.67	2.10
60&61	.24	1.37	1.19	2.15	1.16	.74	1.67	2.37	2.45	2.02
61&62	.34	1.18	1.45	1.77	.96	1.57	1.79	1.91	1.77	1.98
62&63	.34	1.74	.70	1.91	1.95	1.25	2.15	1.79	1.64	2.31
63&64	.50	1.60	2.15	1.88	.91	.96	1.71	2.13	1.98	2.25
64&65	.42	1.23	1.13	1.98	1.60	1.08	1.98	1.77	1.88	2.06
65&66	.40	1.49	1.26	2.02	1.47	.84	1.95	2.31	1.98	1.62
66&67	.02	1.25	2.06	2.19	.76	1.55	1.67	1.67	2.19	3.50
67&68	.14	1.30	.74	1.62	2.02	1.60	1.98	2.02	1.85	1.98
68&69	.17	1.64	1.39	2.19	1.21	.79	1.69	1.91	1.69	1.91
69&70	.05	1.28	1.47	2.06	1.03	1.23	1.64	1.91	1.95	1.71
70&71	.12	1.03	1.47	1.67	1.1	1.51	1.95	1.69	1.98	1.71
71&72	.42	1.06	1.18	1.55	1.62	1.32	2.31	1.91	1.64	1.79
72&73	.50	1.21	1.32	1.95	1.43	1.04	1.98	2.02	1.69	1.60

Correlations and Standard Deviations*

Combinations of [illegible]	r	Average X	σx	Average Y	σy
L - L	0.47	1.20	0.10	14	9.48
L - I	0.00	1.35	0.09	12	4.74
L - D	0.07	1.47	0.06	10	5.16
I - L	0.17	1.38	0.08	13	4.47
I - I	0.11	1.30	0.07	15	11.46
I - D	0.16	1.53	0.10	10	4.49
D - L	0.26	1.37	0.16	13	4.95
D - I	- 0.08	1.58	0.09	9	4.28
D - D	- 0.06	1.31	0.09	16	9.88
Y - Y	0.61	1.10	0.09	13	6.66
Y - N	0.37	1.12	0.04	15	3.61
N - Y	0.44	1.13	0.02	15	2.24
N - N	0.29	1.05	0.06	13	6.84

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* For the meanings of symbols, see page 16.

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